RACKET STRUNG IN DOUBLE DIAGONAL STRINGING PATTERN WITH FRAME MARKINGS AND METHOD

FIELD OF THE INVENTION

The present invention relates to sports rackets, in particular tennis rackets, and a method for stringing rackets. This application claims priority of U.S. Provisional Application #60/173,239 filed on December 28, 1999.

BACKGROUND OF THE INVENTION

Rackets are generally strung in an orthogonal, two-directional weave, with one axis being substantially parallel to the handle, and the other substantially perpendicular to the handle. Examples of such stringing are shown in U.S. Patent No. 5,443,575 to Huang, and U.S. Patent No. 5,478,072 to Kanno et al. Advances have been made in the stringing of sports rackets by including diagonal strings, as disclosed for example in U.S. Patent No. 4,184,679 to Mishel, and U.S. Patent No. 6,089,997 to Hauptman et al. However, in these diagonal stringing arrangements, the racket still includes an additional horizontal or vertical string, which significantly complicates the stringing process, increases the amount of string required and thereby adds difficulty and cost to the racket manufacture. Other diagonal stringing arrangements have been proposed, however such other arrangements have required complex structural adjustments to compensate for distorting stresses in the racket head. As a result, purely diagonally strung rackets have to date not achieved success in the market.

SUMMARY OF THE INVENTION

According to the present invention, by orienting two sets of strings in opposite directions, diagonal to the handle, there is a possibility of extra spin on the ball resulting. The double diagonal stringing pattern described herein may tend to be more gentle on a player's elbow than conventional stringing. This is because the angular strings disperse the harmful vibrations away from the handle held by the player, while a conventional racket directs the vibration directly toward the handle, via the Mains, which are the strings that are parallel to the handle.
Broadly, the present invention is a method, system and design for stringing a racket in a double diagonal pattern, at specific angles, such that the original shape of the frame will not be distorted. The preferred angle of the diagonals is chosen by starting at 55 degrees for an oval shape frame and generally spacing the stringing 3/8 inches apart, although other spacing is also possible. Next, the racket is drilled, then strung using that angle as the angle for the diagonals. The frame measurements are then checked against the original frame measurements. If there is distortion, a new diagonal angle is chosen, the pattern re-designed, and so on, each time increasing or decreasing the diagonal angle by a certain amount of degrees based on the amount of distortion obtained after the first stringing. For every 1/8 inch of shortening, the diagonal angle, with respect to a horizontal line drawn through the vertex of the angle, is reduced one degree. For a shortened frame, this angle change squeezes the frame more in the horizontal direction across the frame, thus counteracting the shortening. For every 1/8 inch of elongation, the angle is increased one degree, to make the angle more vertical, to compress the frame less in the horizontal direction, and thus to counteract the elongation. The purpose and intent of choosing this angle and spacing between strings is to have a stringing pattern that does not distort the frame.

Finding the correct angle is important to the success of this double diagonal pattern so as to create a structurally sound product.

Another feature of the invention is to enable the player to reap the benefits of added spin, added power (from the elasticity of longer diagonal string segments which are also more equal in length to one another compared to conventionally strung rackets). Also, the diagonal pattern may reduce vibration transmitted to the player's arm by dispersing the impact away from the handle.

The rackets would have markings around the hoop of the frame to show where the pattern starts and connect-the-dot numbers showing the path of where each string is inserted and where it should be tensioned. These notations, for instance, can be colored, such as red dots, red numbers, or red letters *R* for right diagonals (diagonals that are oriented downward towards the right) or other colored dots and colored numbers and letters *L,* used for left diagonals (diagonals that are oriented downward towards the left). The frame markings at the places where tension is applied can be underlined. The word Start could shows where to begin and the word KNOT shows where to end. This will make the pattern easy for stringers to follow during the stringing process.

The information given herein is for tennis rackets, but the diagonal method of creating a prototype and marking the frame can be applied to squash, racquetball and badminton rackets, with equal success.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates a tennis racket strung according to one embodiment of the present invention.
Fig. 2 illustrates an unstrung frame.
Fig. 3 shows the problems created when the angle (referring to Angle A of Figure 1) is oriented too much in the vertical direction, indicating that such angles create too much pull in the vertical direction, thus causing the frame to shorten.
Fig. 4 shows the problems created when Angle A (Figure 1) is too flat, creating too much pull in the horizontal direction, thus causing the frame to elongate.
Figures 5A – 5E shows the actual stringing process of stringing the double diagonal weave according to an embodiment of the invention, with rectangular boxes on the draqwing representing the clamping devices used to hold tension on the strings.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In Fig. 1, horizontal Line H intersects with a Left Diagonal string of the set of diagonals that are angled downward to the left, forming Angle A. The opposite diagonals, those that are angled downward to the right, would form an angle of equal measure with horizontal Line H. In this embodiment of the invention, when finally strung, Angle A = 53 degrees, but the angle may be may varied slighty towards the outer diagonals so the strings will not coincide and thus interfere with where the racket is attached to the frame. Thus, the angle of the diagonals may be in a range of 51-58 +/- 2 degrees. The spacing between the diagonal strings, when a perpendicular is drawn from one diagonal to its adjacent diagonal strings may be 3/8 inch, or the spacing between the diagonals may vary. The spacing may be in a range of 1/4 inch to 1 inch, depending on the frame shape. In this arrangement, according to a preferred embodiment of the invention, it is possible to

tension only every other string in order to facilitate the stringing process, without degrading the racket performance.

Based on typical string tension of about 55-65 pounds, testing must be done to determine the specific angle of the diagonal strings that does not lead to frame distortion. The unstrung shape of the racket in Fig. 2 is preferably maintained as closely as possible after stringing. Excessive vertical tension shortens the frame as shown in Fig. 3, whereas excessive horizontal tension lengthens the frame as shown in Fig. 4. When a string pattern causes a change in frame shape, the racket's structural stability is compromised. The fibers in the frame weaken when they are rearranged as the shape changes. The frame is under tension as the shape changes.
Once the racket has been strung, if the frame has distorted, the racket can be re-strung by placing the strings into different string hole locations. If that fails to correct the problem, the racket must be re-drilled with string holes in different locations so as to accommodate a pattern with a different angle, with the goal of obtaining a distortion free racket.

Additionally, frame markings around the racket hoop would indicate the starting points and the placement of the left and right diagonal strings. The string hole locations have been exactly placed for optimum frame strength and ease of stringing for stringers, and so as not to interfere with where frames are secured to stringing machines. The focus of the design is to make it easy for stringers to do, and create excellent playability for the player.

Angle A in Fig. 1, upon completion of the stringing, is 53 degrees. As strung, the racket frame of Fig. 1 was not distorted. In Fig. 1, the strings are generally spaced 3/8 inches apart, but other variable spacing is also possible. With other rackets the angle of the diagonal strings may range from 51 to 58 +/- 2 degrees, or may be some other figure depending on the shape of the frame. For instance, a circular frame might use 60 degrees.

The method for achieving the stringing arrangement according to a preferred embodiment of the invention is as follows:
1. The first step is to select a racket of a certain shape and make a tracing of the racket head, then create a grid of parallel lines, generally spaced 3/8 inches apart, or at varied widths apart, then orient lines such that they form a diagonal angle, (sloping downward towards the left) of 55 degrees with respect to a horizontal line H as shown in Fig. 1. The next step is to place an identically spaced corresponding grid of generally parallel lines sloping in the opposite direction, downward towards the right.
2. Determine where the pattern intersects the hoop, and drill holes on the frame at those locations. Then put notation markings above each hole on the frame, noting the path of the string pattern, where it begins, and where the strings are tied off with a knot.
3. For the racket in Fig. 1, one 40-foot length of string is inserted at the top of the frame, with the midpoint of the string length at the top of the frame. One half of the string will be used to string the left diagonals; the other half of the string length will be used to string the right diagonals. The stringing of this frame can also be accomplished by using two string lengths that have been knotted with a start knot. The string may be colored in two colors to string each set of diagonals in a different color.
4. The stringing is continued, as shown in Fig. 5A-5E, alternating tensioning one diagonal in each diagonal direction until the frame is completed. The clamps used to hold tension on the

strings are shown as rectangular boxes attached to the strings.
5. After the frame is strung, the dimensions are measured against the original dimensions before stringing.
6. If the frame has changed dimensions, then the angle of the diagonals, Angle A (Fig.1) must be changed. For every 1/8 inch of distortion, the measure of Angle A has to be adjusted one degree. If the frame has elongated, increase the angle of the diagonals, Angle A (Fig.1) by one degree for every 1/8 inch of elongation. If the frame became shorter, decrease Angle A (Fig.1) by one degree for every 1/8 inch of shortening.